

Department of Parasitology and Parasitic Diseases,
Agricultural College of Lublin
Head: Doc. Dr. Eugeniusz Żarnowski

Bernard BEZUBIK and Stefan FURMAGA

The parasites in *Macacus cynomolgus* L.
from Indonesia

Pasożyty *Macacus cynomolgus* L., pochodzących z Indonezji

Continuing studies on the helminthofauna of monkeys imported by the Laboratory for the Production of Sera and Vaccines in Lublin for the production of the polio vaccine, we examined 60 *Macacus cynomolgus* L., originating from Indonesia, to determine the set of their parasitofauna and to compare the species of parasites with the helminths previously found in *M. rhesus* from China (Bezubik et Furmag, 1959).

The postmortem examinations of monkeys, which died mainly in the period of acclimatization, were conducted from August 31, 1959 till October 21, 1959. All internal organs were examined using the generally known methods of preservation, staining and clarifying of parasites in order to determine their species classification. In cases of large nematodes partial digestion was applied using the aqueous solution of the hydrochloric acid (in proportion 1:1) in order to expose quickly the chitin parts.

Out of the total number of 60 examined monkeys 39 (65%) were invaded with parasites; five monkeys (8%) were invaded with tape-worms, with nematodes — 35 monkeys (58%), with *Pentastomida* — 2 monkeys (3%), with mites — 3 monkeys (5%). 23 monkeys (38%) were invaded by one species of parasite, 9 monkeys (15%) — with two species, 4 monkeys (7%) — with three species, 3 monkeys (5%) — with four species of parasites. 21 monkeys (35%) were free from parasites.

In the examined monkeys the following species of parasites were found: *Cestoda* — *Bertiella studeri* (Blanchard, 1891); *Nematoda* — *Oesophagostomum bifurcum* (Creplin, 1849), *Try-*

panoxyuris bipapillata (Gedoelst, 1916), *Streptopharagus pigmentatus* (Linstow, 1897), *Streptopharagus* sp., *Characostomum asmilium* (Railliet, Henry et Joyeux, 1913), *Physaloptera tumefaciens* Henry et Blanc, 1912; *Pentastomida* — larva of *Armillifer moniliformis* (Diesing, 1836); *Arachnida* — *Pneumonyssus simicola* Banks, 1901. Table I represents the extensity and intensity of invasion of *M. cynomolgus* with the separate species of parasites.

The comparison of the parasitofauna of *Macacus rhesus* from China (Bezubik et Furmaga, 1959) and the presently examined *M. cynomolgus* from Indonesia is interesting. In *M. cynomolgus*

Table I
Extensity and intensity of invasion

No.	Species of parasite	Examined	Invaded	%	Intensity	Habitat
1	<i>Bertiella studeri</i> (Blanchard, 1891)	60	5	8	1—3	duodeum
2	<i>Oesophagostomum bifurcum</i> (Crepl., 1849)	60	28	47	1—15	caecum, large intest.
3	<i>Trypanoxyuris bipapillata</i> (Ged., 1916)	60	1	1.6	1	caecum
4	<i>Streptopharagus pigmentatus</i> (Linst., 1897)	60	5	8	1—3	stomach, intest.
5	<i>Streptopharagus</i> sp.	60	2	3	2—6	caecum
6	<i>Trichocephalus trichiurus</i> (L., 1771)	60	8	13	1—5	caecum, large intest.
7	<i>Characostomum asmilium</i> (Raill., Henry, Joy., 1913)	60	4	7	1—15	duod., small intest.
8	<i>Physaloptera tumefaciens</i> (Henry et Blanc, 1912)	60	10	17	1—12	stomach, duod.
9	<i>Armillifer moniliformis</i> (Dies, 1836)	60	2	3	2—7	mesentery
10	<i>Pneumonyssus simicola</i> Banks, 1901	60	3	5	5—50	lungs

Table II

Comparison of parasites of *Macacus rhesus* from China
and *M. cynomolgus* from Indonesia

No	Species of parasite	<i>M. cynomolgus</i>		<i>M. rhesus</i>	
		exten- sity	intensity	exten- sity	intensity
1	<i>Bertiella studeri</i> (Blanchard, 1891)	8%	1 — 3	3%	1 — 2
2	<i>Oesophagostomum bifurcum</i> (Crepl., 1849)	47%	1 — 51	55%	1 — 50
3	<i>Trypanoxyuris bipapillata</i> (Ged., 1916)	1.6%	1	1%	1
4	<i>Streptopharagus pigmentatus</i> (Linst., 1897)	8%	1 — 3	24%	1 — 320
5	<i>Streptopharagus</i> sp.	3%	2 — 6	—	—
6	<i>Trichocephalus trichiurus</i> (L., 1771)	13%	1 — 5	27%	1 — 25
7	<i>Characostomum asmilium</i> (Raill., Henry, Joy., 1913)	7%	1 — 15	—	—
8	<i>Physaloptera tumefaciens</i> (Henry et Blanc, 1912)	17%	1 — 12	—	—
9	<i>Armillifer moniliformis</i> (Dies., 1836)	3%	2 — 7	—	—
10	<i>Pneumonyssus simicola</i> Banks, 1901	5%	5 — 50	—	—
11	<i>Fasciola hepatica</i> L., 1785	—	—	5%	1 — 14
12	<i>Ogmocotyle indica</i> (Bhalerao, 1942)	—	—	3%	12 — 200
13	<i>Cysticercus tenuicollis</i> (Rud., 1810)	—	—	1%	4
14	<i>Ternidens deminutus</i> (Raill. et Henry, 1905)	—	—	21%	1 — 100

there is an absence of trematodes but there occur *Pentastomida* and mites which are absent in *M. rhesus*. These relations are shown in the Table II which presents also the comparison of the extensity and intensity of invasion with the separate species of parasites in the two species of monkeys.

CESTODA

Bertiella studeri (Blanchard, 1891) Stiles et Hassall, 1902

Syn.: *Bertia studeri* Blanchard, 1891; *Bertia satyri* Blanchard, 1891; *Taenia (Bertia) confera* Meyner, 1895; *Taenia studeri* (Blanchard, 1891) Braun, 1896; *Taenia satyri* (Blanchard, 1891) Braun, 1896; *Bertiella satyri* (Blanchard, 1891) Stiles et Hassall, 1902; *Bertiella confera* (Meyner, 1895) Stiles et Hassall, 1902; *Bertia polyorchis* Linstow, 1905; *Bertiella cercopitheci* Beddard, 1911.

Hosts: *Homo sapiens* L., *Simia satyrus* L., *Anthropopithecus troglodytes* (L.), *Hylobates hoolock* Harlan; *Cercopithecus pygarythrus* Cuvier, *C. smithi* Matschie, *C. neglectus* Schl., *C. fuliginosus* (Geoffr.), *Macacus rhesus* (Audeb.), *Hamadryas hamadryas* L., *Cynomolgus cynomolgus* L., *C. irus* L., *C. sinicus* L.

Habitat: intestine.

Geographical distribution: Africa, South Asia, Philippine Islands.

B. studeri was found in the duodenum of 5 (8%) *M. cynomolgus* in numbers ranging from 1 — 3 specimens.

NEMATODA

Oesophagostomum bifurcum (Creplin, 1849) Railliet et Henry, 1906

Syn.: *Strongylus bifurcum* Creplin, 1849; *S. attenuatus* Leidy, 1856; *S. cynocephali* Molin, 1861; *Oesophagostomum brumpti* Railliet et Henry, 1905; *Oe. attenuatum* (Leidy, 1856) Railliet et Henry, 1906; *Oe. stephanostromum* Chewlett et Corté, 1908; *Oe. apiostomum* Leiper, 1911 part.; *Oe. maurum* Hung, 1926.

Hosts: the man and various species of monkeys.

Habitat: small and large intestine and caecum.

Geographical distribution: Africa, Central Asia. In Indonesia hitherto not described.

In our material found in the large intestine and caecum in 28 (47%) of monkeys in numbers ranging from 1 to 51 specimens.

It should be stressed, that in *M. cynomolgus* there occur mainly young forms of *Oe. bifurcum*. The length of young males was 4.4 — 10.5 mm, width 0.15 — 1.27 mm, dimensions of oesophagus 0.3 — 0.56 × 0.09 — 0.15 mm, length of spicules 0.71 — 0.89 mm. Young females, without eggs, attained the dimensions 5.3 — 13.8 × 0.16 — 0.3 mm, the oesophagus 0.32 — 0.55 × 0.1 — 0.15 mm. The distance, however, between the anus and the posterior end of the body (0.22 — 0.26 mm) and the distance between the vulva and the anus (0.24 — 0.29) were larger than in adult forms.

Trypanoxyuris bipapillata (Gedoelst, 1916)

Syn.: *Oxyuris bipapillata* Gedoelst, 1916; *Enterobius bipapillatus* (Gedoelst, 1916) Baylis, 1923.

Hosts: *Anthropopithecus troglodytes* Blum., *Cercopithecus saeba* L., *Macacus rhesus* Audeb.

Habitat: intestine, mainly caecum.

Geographical distribution: Africa, China; in Indonesia hitherto not described. One female was found in the caecum of one (1.6%) *M. cynomolgus* (new host).

Streptopharagus pigmentatus (Linstow, 1897) Railliet
et Henry, 1918

Syn.: *Spiroptera pigmentata* Linstow, 1897.

Hosts: *Cercopithecus albogularis* Skyes, *C. diana diana* L., *C. leucampyx* Fisch., *Macacus* sp., *Hylobates leucogenys* Ogilby, *H. hoolock* Hatlan, *Pithecus fuscatus* Blyth, *Marmota marmota*.

Habitat: stomach and intestines.

Geographical distribution: Asia. In Indonesia hitherto not described.

S. pigmentatus was found in the stomach, duodenum and small intestine of 5 (8%) *M. cynomolgus* (new host) in numbers 1 — 3 specimens.

Because the nematodes from *M. cynomolgus* differ by their dimensions from the descriptions given in the literature (including

also our material from *M. rhesus* — Bezubik et Furmaga, 1959), we present their short description.

Male: length of body 22.5 — 24.0 mm, width 0.54 — 0.83 mm. Size of pharynx 0.21 — 0.3 mm, and of the oesophagus 5.6 — 5.8 mm; spicules attain the length: left 3.8 — 4.26 mm, right 0.6 mm; gubernaculum 0.066 — 0.071 mm in length, length of tail 0.35 — 0.39 mm.

Female: length of body 23.2 — 31.5 mm, width 0.83 — 1.1 mm. Pharynx 0.25 — 0.31 mm, oesophagus 5.2 — 5.8 mm. The distance between the anus and the posterior end of body measures 0.43 — 0.45 mm. Size of eggs 0.031 — 0.040 × 0.019 — 0.024 mm.

Streptopharagus sp.

Host: *Macacus cynomolgus* L.

Habitat: caecum.

Geographical distribution: Indonesia.

Beside the typical (although a bit smaller than the specimens described in the literature) *Streptopharagus pigmentatus* (Linstow, 1897) from stomach, duodenum and small intestine, we found in 2(3)%) *Macacus cynomolgus* in caecum some small specimens (in one monkey two females, in other 4 males and 2 females) of *Streptopharagus* which, owing to the lack of the suitable literature, could not be determined in a proper way. We are giving, therefore, a short description of these specimens.

Male: Length of the body 11.8 — 12.4 mm, width 0.2 — 0.32 mm. Pharynx attains the length 0.1 — 0.13 mm, oesophagus 2.9 — 3.5 mm. Left spicule measures 4.85 — 5.2 mm, right spicule 0.35 — 0.43 mm, gubernaculum 0.047 — 0.055 mm. Length of the tail is 0.19 — 0.2 mm.

Female: Length of the body 17.0 — 18.5 mm, width 0.38 — 0.45 mm. Length of pharynx 0.11 — 0.13 mm, length of oesophagus 2.9 — 3.5 mm. The tail attains the size 0.21 — 0.24 mm. Dimensions of eggs: 0.026 — 0.033 × 0.012 — 0.013 mm.

Trichocephalus trichiurus (L., 1771)

Hosts: *Homo sapiens* L. and some higher monkeys.

Habitat: large intestine and caecum.

Geographical distribution: cosmopolitan.

In 8 (13%) *M. cynomolgus* found in the large intestine and caecum in numbers ranging from 1 to 5 specimens.

Characostomum asmilium (Railliet, Henry et Joyeux, 1913)

Hosts: *Cercopithecus callitrichus*, *Erythrocebus patas*, *Macacus nemestrinus*, *M. cynomolgus*.

Habitat: intestine.

Geographical distribution: French Guinea, Asia.

In our material *Ch. asmilium* was found in the duodenum and small intestine of 4 (7%) *M. cynomolgus*, in numbers ranging from 1 to 15 specimens.

Physaloptera tumefaciens Henry et Blanc, 1912

Syn.: *Chlamydonema tumefaciens* (Henry et Blanc, 1912) Yorke et Maplestone, 1926.

Hosts: *M. cynomolgus*, *M. fascicularis*, *Pithecus fascicularis*.

Habitat: stomach and duodenum.

Geographical distribution: Asia.

Ph. tumefaciens was found in 10 (17%) *M. cynomolgus*, in numbers 1 — 12 specimens.

PENTASTOMIDA

Armillifer moniliformis (Diesing, 1836) Sambon, 1922 — larva

Syn.: Adult forms: *Pentastoma moniliforme* Diesing, 1836, *P. wedlii* Cobbold, 1886, *Linguatula moniliforme* Mégnin, 1880, *Porocephalus moniliformis* Shipley, 1889. Larval forms: *Pentastomum tornatum* Creplin, 1849 part., *Pentastoma aonyxis* Macalister, 1877, *Porocephalus aonyxis* Shipley, 1898, *Pentastomum constrictum* Herzog et Hare, 1907.

Definite hosts: snakes of the genus *Python* and *Tropidonotus*.

Intermediate hosts: various mammals.

Habitat: adult forms in lungs and trachea of snakes, larval forms in various organs of mammals.

Geographical distribution: Indochina, Central China, Central Africa, Australia.

The larvae of *A. moniliformis* were found by us in mesentery in 2 (3%) of the examined monkeys, in numbers ranging from 2 to 7 specimens.

Dimensions of the larvae: the body length fluctuates within the limits 12.6 — 14.5 mm, width of cephalothorax 1.85 — 2.1 mm, width of abdomen formed by 27 — 31 segments amounts to from 1.6 — 1.8 mm.

ARACHNIDA

Order Acarina Nitzsch, 1818

Pneumonyssus simicola Banks, 1901

Hosts: various monkeys.

Habitat: lungs.

Geographical distribution: Asia, Africa.

P. simicola was found in lungs of 3 (5%) *M. cynomolgus*, in numbers ranging from 2 to about 50 specimens.

Postmortem findings: In the pulmonar parenchyma, particularly under the pleura there were found lingsh-grey or yellow vesicles of the size of pea or lentil, which resemble by their appearance emphysematic vesicles. These vesicles were formed by single cavities, filled up with air, sometimes with a scanty amount of pus. The wall of every vesicle was formed by connective tissue. In every vesicle there was one, sometimes several parasites.

The male attains the dimensions $0.47 - 0.59 \times 0.22 - 0.27$ mm; The females $0.77 - 0.83 \times 0.41 - 0.47$ mm, the size of eggs $0.17 - 0.18 \times 0.11 - 0.12$ mm; length of the larva 0.35 — 0.41 mm, width 0.24 — 0.28 mm.

In all forms (males, females, larvae) there appear on every limb the caruncle (sucker) and one pair of claws.

Authors' address:

Katedra Parazytologii W.S.R.
Lublin, Akademicka 11

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STRESZCZENIE

Autorzy zbadali 60 *Macacus cynomolgus* L., pochodzących z Indonezji, i stwierdzili następujące gatunki pasożytów:

Tasiemce: *Bertiella studeri* (Blanchard, 1891) Stiles et Hassall, 1902;

Nicienie: *Oesophagostomum bifurcum* (Creplin, 1849) Railliet et Henry, 1906, *Trypanoxyuris bipapillata* (Geddoelst, 1916), *Streptopharagus pigmentatus* (Linstow, 1897) Railliet et Henry, 1918, *Streptopharagus* sp., *Trichocephalus trichiurus* (L., 1771), *Characostomum asmilium* (Railliet, Henry et Joyeux, 1913, *Physaloptera tumefaciens* Henry et Blanc, 1912;

Wrzęchy: *Armillifer moniliformis* (Diesing, 1836) Sambon, 1922 — larwa;

Pajęczaki, roztocza: *Pneumonyssus simicola* Banks, 1901.

Stwierdzono, że *Macacus cynomolgus* jest nowym żywicielem dla *Trypanoxyuris bipapillata* i *Streptopharagus pigmentatus*.